

Appl. No. 09/677,545

Amdt. Dated February 27, 2004

Reply to Office Action of December 1, 2003

CLAIM AMENDMENTS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (currently amended): A trench capacitor, comprising:

a substrate formed with a trench;

said trench having an upper region and a lower region and a conductive trench filling formed, at least in said lower region of said trench, entirely of tungsten-containing material selected from the group consisting of tungsten-nitride, tungsten-silicide, and pure tungsten, said conductive trench filling being disposed in said upper and lower regions of said trench;

an insulation collar formed in said upper region;

a buried well formed in said substrate, said lower region at least partly extending through said buried well; and

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a dielectric layer formed of tungsten oxide material lining said lower and upper regions, said dielectric layer serving as a capacitor dielectric.

2 (canceled).

3 (original): The trench capacitor according to claim 1, wherein said dielectric layer has a dielectric constant greater than 50.

4 (original): The trench capacitor according to claim 1, including a barrier layer disposed between said dielectric layer and said substrate.

5 (original): The trench capacitor according to claim 1, including a barrier layer disposed between said dielectric layer and said conductive trench filling.

6 (original): The trench capacitor according to claim 1, including:

a barrier layer disposed between said dielectric layer and said substrate; and

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a further barrier layer disposed between said dielectric layer and said conductive trench filling.

Claim 7 (previously presented): The trench capacitor according to claim 20, wherein said barrier layer is formed of a material selected from the group consisting of silicon oxide, silicon nitride, oxynitride, tungsten nitride, titanium nitride, and tantalum nitride.

8 (original): The trench capacitor according to claim 5, wherein said barrier layer is formed of a material selected from the group consisting of silicon oxide, silicon nitride, oxynitride, tungsten nitride, titanium nitride, and tantalum nitride.

9 (original): The trench capacitor according to claim 1, including a vertical transistor disposed in said trench.

10 (currently amended): A method of producing a trench capacitor, the method which comprises:

introducing a buried well into a substrate;

forming a trench in the substrate, the trench having an upper region and a lower region;

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forming an insulation collar in the upper region;

providing a capacitor dielectric by forming a dielectric layer of tungsten oxide lining the lower region; and

filling the trench with a conductive trench filling for providing an inner capacitor electrode, the conductive trench filling being formed, at least in the lower region of the trench, of a tungsten-containing material selected from the group consisting of tungsten-nitride, tungsten-silicide, and pure tungsten.

11 (original): The method according to claim 10, which comprises forming the dielectric layer by oxidizing a tungsten-containing layer.

12 (original): The method according to claim 11, which comprises forming the tungsten-containing layer from a material selected from the group consisting of tungsten nitride, tungsten silicide, and pure tungsten.

13 (original): The method according to claim 10, which comprises forming the dielectric layer by oxidizing a tungsten-containing layer at a temperature between 200°C and

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600°C in an atmosphere containing at least one element selected from the group consisting of O₂, H₂O, N₂O, and NO.

14 (original): The method according to claim 10, which comprises forming the dielectric layer by a reactive sputtering of tungsten in an oxygen-containing atmosphere.

15 (original): The method according to claim 10, which comprises forming the dielectric layer as a layer with a dielectric constant greater than 50.

16 (original): The method according to claim 10, which comprises subjecting the dielectric layer to a thermal treatment at a temperature between 550°C and 1100°C for providing the dielectric layer with a dielectric constant greater than 50.

17 (canceled).

18 (original): The method according to claim 10, which comprises forming a tungsten-containing layer by carrying out a selective chemical vapor deposition process at a temperature between 200°C and 400°C and using tungsten hexafluoride as a starting material.

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19 (original): The method according to claim 10, which comprises:

forming a tungsten-containing layer from a material selected from the group consisting of tungsten nitride, tungsten silicide, and pure tungsten; and

producing the dielectric layer from the tungsten-containing layer.

20 (previously presented): A trench capacitor, comprising:

a substrate formed with a trench;

said trench having an upper region and a lower region and a conductive trench filling formed of tungsten-containing material disposed in said upper and lower regions of said trench;

an insulation collar formed in said upper region and having an upper end;

a buried well formed in said substrate, said lower region at least partly extending through said buried well;

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a dielectric layer formed of tungsten oxide material lining said lower and upper regions and having an upper end, said dielectric layer serving as a capacitor dielectric;

a barrier layer disposed between said dielectric layer and said substrate and having an upper end, said barrier layer disposed in said upper and lower regions; and

an insulation layer disposed on a top surface of said dielectric layer and extending from said upper end of said barrier layer to said upper end of said insulation collar and said dielectric layer.

21 (previously presented): The trench capacitor according to claim 20, wherein said barrier layer is formed of a metal nitride material.

22 (previously presented): The trench capacitor according to claim 20, wherein each of said conductive trench filling, said dielectric layer, and said insulating layer has a top surface, said trench capacitor including a conductive buried bridge portion covering at least a portion of each said top surface of said conductive trench filling, said dielectric layer, and said insulating layer and connecting to a doped region of a transistor.

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23 (canceled).

24 (previously presented): The trench capacitor according to claim 20, wherein said conductive trench filling is formed, at least in said lower region of said trench, entirely of a material selected from the group consisting of tungsten-nitride, tungsten-silicide, and pure tungsten.